

## APPLICATION OF ARCS MODEL AND MOTIVATIONAL DESIGN IN ENGINEERING SUBJECTS – A CASE STUDY

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### ABSTRACT

*Engineering Students are not concentrating on their studies and are prone to have backlogs. This might be because of many reasons. As a responsibility, faculty needs to motivate the students and make their subject interesting to student. This paper describes the implementation of ARCS model of Motivational design, given by John Keller. ARCS model is used to motivate the students and create the interest in them. The implementation of ARCS model in each and every lecture will increase the interest in the students. This study indicates that, the systems which are developed on basis of ARCS model raise, during the instruction develop a positive expectation for success and help, having a satisfaction in their work.*

**KEYWORDS:** ARCS Model, Motivational Design & Engineering Students

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### 1. INTRODUCTION

#### 1.1 Reasons for Lack of Interest in Students

- Students are not interested in the course
- Students do not believe in their effort
- Students get de-motivated by the grade given by faculty
- Students do not feel supportive environment in the classroom
- Students have other priorities
- Student may have their personal problems which affects the motivation.
- Student have Fear of Failure
- Students do not have any goal in their career.

#### Strategies

In order to motivate the students and make them involved in the activities, we have many number of ways. Some of them are:

- To decrease the focus on individual grades
- Asking them to self evaluate themselves

- Conducting the collaborative activities

## 1.2 ARCS Model

### 1.2.1 What is ARCS

The ARCS Model of Motivational design is created by John Keller to create the interest in the students. John Keller made this theory to give a systematic model for motivating the student. ARCS refers to Attention, Relevance, Confidence and Satisfaction. That is, the student attention need to be created with a relevance to the future use through which the student feels confident and satisfied.

#### 1. Attention

It refers to the learner's interest. It is critical to get and hold the learners' interests and attention. So Keller has proposed again sub divided into three categories.

##### a. Perpetual Arousal

To grab the attention of the student with uncertain situations or surprises

- **Concreteness:** This is to grab the attention by giving the related examples for the topic
- **Incongruity and Conflict:** This describes that giving an opposite point of view of a particular discussion might grab the students attention.
- **Humor:** Enlightening the students using humor.

##### b. Inquiry Arousal

To get the attention of students, can give challenging questions or critical thinking questions for students to think. It is sub divided into categories:

- **Participation:** Students are given a role play or some activity to participate so that their attention increases
- **Enquiry:** Students to be given with some higher order thinking skills questions for making students to think on that topic.

##### c. Variability

To grab the attention of the students, need to use different ways of teaching methods.

#### 2. Relevance

Keller says, giving relevance of a topic makes students to understand the topic in a clear way. Giving relevance for the topic to be taught will bridge the gap between the syllabus and the real world. He divided this into three sub categories:

**a. Goal Orientation:** By giving the usefulness of the topic students get interest to listen the class.

- **Present Worth:** Giving the use of the learning this topic in present situation
- **Future Usefulness:** Giving the use of the topic in their future.

**b. Motive Matching:** Aligning with their basic motivations

- Needs Matching: Communicating to align with their needs
- Choice: Giving them options and control over their type of learning a new concept

**c. Familiarity**

- Modeling: Need to show a model of the topic or model used before
- Experience: Need to give relevance to the before concept experienced.

**3. Confidence**

This element develops the confidence in the students and makes them to expect success through their learning processes. There is a correlation between confidence level and success expectation. That's why providing estimation of probability of the success to learners is important.

- **Learning Requirements:** Need to give objectives behind teaching this topic and need to give the evaluation criteria
- **Success Opportunities:** Giving them the opportunity to success by providing the varied experiences and also giving the constructive feedback about the mistakes did by them increases confidence in them
- **Personal Control:** Learners need to get control over their learning process so that they can feel that their success does not totally depend on external factors. Instead, they have internal factors affecting their success.

**4. Satisfaction**

There is direct relation between motivation and satisfaction. Learners should be satisfied of what they achieved during the learning process. That is they need to get good marks for work they have kept.

- **Intrinsic Reinforcement:** Encourage intrinsic enjoyment of learning experience so that learners have fun, continue the learning process without expecting reward or other kind of external motivational elements.
- **Extrinsic Rewards:** Provide learners with positive feedback, rewards, and reinforcements
- **Equity:** Maintain consistent standards and consequences for success. Use consistent assessment rubrics, and share them with learners.

**1.2.2 Why ARCS**

When work began in 1979, on the development of the ARCS Model, there were no theories or models about how to motivate students and how to make them learn. In education, motivation is the very important factor that affects the students. Until 1979, the education system was different. The concentration was on how to teach and go. But with the Keller's proposal of the motivational model, the theories were evolved. Survey was done and psychological studies were taken place after which they found that student motivation towards study is the most important factor for the student education. So, Keller has proposed the motivational design theory for motivation of the student. This will show how to motivate the student towards learning a particular topic. Works have been done to help students learn how to be self motivated and Wlodkowski has expanded this theory, towards application of knowledge. The ARCS model is based on

macro theory of motivation and instructional design developed by Keller in 1979.

## 2. IMPLEMENTATION

Implementing the Arcs model into the Engineering subjects can improve the students performance and can achieve better results. In this paper, I have considered one subject and implemented in one section. Here is the example of implementing the ARCS model into the Engineering Subjects. The subject considered is Engineering Drawing. While implementing the ARCS model into the subject, learning objectives of that topic is to be defined. The learning objectives are the expectations of a faculty from the students after completion of the topic. The table1 below is the format that I have followed to plan the implementation of the ARCS model in Engineering Drawing and also have defined the learning objectives for the topic.

**Subject Name:** Engineering Drawing

**Unit No:** 3

**Topic:** Projection of Solids

### Learning Objectives

- By the end of this session, the student will be able to **understand** what a solid is and how it is placed in a quadrant system
- By the end of this session, the student will be able to **evaluate** the position and imagine how it will be projected on to the principle planes to draw the initial projections
- By the end of this session, the student will be able to **produce** the projections of any solid or object easily.

**Table1: Planning the Implementation of ARCS Model**

Component	Implementation Strategies
<b>Attention</b> (What is interesting about this?)	<p><b>1) Perceptual Arousal:</b> While introducing about the projection of solids I need to say the different types of solids. So I take the different solids sticking a question mark on them while going to class. Then while introducing, I ask them what each solid is called. Make the class interactive through which they become active in the class.</p> <p>Plan of action in class:</p> <ul style="list-style-type: none"> <li>• Say the topic and then show the solids and ask them to name the solid – 5min</li> <li>• Explain each solid – 5min</li> </ul> <p><b>2) Variability:</b> Daily I teach them using blackboard so for a change I show the types of solids practically and also show the ppt with position of the solid in the quadrant system and how to project it on to the principle planes.</p> <p><b>3) Inquiry Arousal:</b> To make this, I conduct the activity “<b>In Class Teams</b>” through which I give a problem to think and solve</p> <p>Plan of action in class:</p> <ul style="list-style-type: none"> <li>• Show the ppt of position of solid and explain how the views of it fall on the plane of projection – 10min</li> <li>• Explain one problem considering one of the condition – 5min</li> <li>• Give the activity “<b>In class Teams-Brainstorming Session</b>”, asking them to say the best real time example where they will get through these solids and solve the problem given below. – 10min</li> </ul> <p><b>Question:</b> A triangular pyramid of base side 30mm and height 70mm is resting on one of its slant edge on HP. Draw its projections when the axis is</p>

	inclined at an angle of $30^0$ to HP.
<b>Relevance</b> (Why should I be wasting my time studying this?)	<p><b>1) Goal Orientation:</b> Before introducing any topic or giving lecture about a topic it is a good thing to say students why they need to read that topic why is it useful for them. So I first say the session objectives after going to class. Before explaining the topic, I say the session objectives for this topic-5min</p> <p><b>2) Familiarity:</b> When we say a new topic students feel very enthusiastic but if they are not able to map with the real time examples they cannot feel like listening to class and they do not get the exact idea of the topic. So I give a real time example which is familiar in their daily life (if not possible for every topic, I show an example in the movie) so they feel relevant to their future and listen to the topic carefully. In brainstorming session they think as a team and come with an answer where they apply their knowledge about the topic.</p> <p>During the in class teams activity, I ask the students to mention the real time application of the projections.</p>
<b>Confidence</b> (This is not difficult – I can do it)	<p><b>1) Performance Requirements:</b> I ask students to solve the given question using the example they have provided. I also provide some rubrics to evaluate the individual and team through which they also understand how I am evaluating each they do the same.</p> <p>Students feel confident about their answer as they link with the real time application. The rubrics containing how many points they will get while solving each stage (it comprises of three stages) are written on the board for their understanding. So at the end the student will be confident about the points they achieved and understand how they have performed.</p> <p><b>2) Success Opportunities:</b> During the activity, I walk through the teams and check how they are doing. If any mistakes, I give small clue so that they can improve their basic draft.</p> <p><b>3) Personal Control:</b> In the In class teams activity as I gave a question to solve as a team according to the rubrics, the evaluation also will be done. The evaluation is done through the rubrics given and the points are given to the student teams with feedback about their performance.</p>
<b>Satisfaction</b> (This is great – I have learnt something new and useful)	<p><b>1)Intrinsic:</b> Learning in teams gives enjoyment for them and they learn a lot from their friends.</p> <p>I take their opinions on the activity and the session so that while writing even they understand what they have did in the class from the beginning.</p> <p><b>2)Extrinsic:</b> After the activity, I will evaluate and give the constructive feedback to the students.</p> <p>For example – I will say them “All of you have performed very well and have solved the problem more than I expected.”(By saying more than I expected, they feel more satisfied that we have done well.)</p> <p><b>3)Equity:</b> Each team will be evaluated as per the rubrics given in the class and tags will be given according to their performance.</p> <p>I give tags (like Excellent, Good performer, Time Manager, etc.) to each team through which they feel happy and satisfied that they learned something new and feel it is also useful to apply in real time.</p>

### 3. RESULTS AND DISCUSSIONS

Performance of students is considered before and after implementation of the ARCS model in each lecture for engineering subjects. The performance of students is measured through the pass percentage and Student presence in the class.

#### Criteria 1: Pass Percentage

The pass percentage of the class is considered for an individual subject which is calculated as the number of students passed divided by the total number of students appeared the exam.

The pass percentage of a particular section for a particular subject can be considered to evaluate the results of the implementation of ARCS model. Here the subject considered as an example is Engineering Drawing. In this paper, I have considered the pass percentage of two sections for which the same faculty is teaching the same subject by implementing ARCS model in one section and by not implementing the ARCS model in the other section through which the results can be compared to show the performance.

The two sections that are considered are A and B. In section B, faculty have implemented ARCS and in section A faculty have implemented the ARCS model. The pass percentage of the subject engineering drawing is tabulated in the table 2 below for after implementation of ARCS model and before implementation of ARCS model.

**Table 2: Pass Percentage for Different Subjects for a Particular Section**

Sl. No	Subject	Pass Percentage of section A	Pass Percentage of section B
1.	Mid 1 Result	75%	90%
2.	Mid 2 Result	78%	92%
3.	Final Exam Result	78.35%	95.5%

So from the above table, the pass percentage of the students for any subject is improved in by implementing the ARCS model.

**Criteria 2: Feedback from Students:** After following the ARCS model, feedback is taken from the student about the implementation and are they satisfied with this process or not. The feedback given by the students is good and they said the understanding of the subject is very easy.

The outcomes of the implementation of the ARCS model in the class are

- At the end of the session, the student have **understood** what a solid is and how it is placed in a quadrant system
- At the end of the session, the student **analyzed** the position of the object and drawn how it will be projected on to the principle planes.
- At the end of the session, the student have **produced** the projections of the given solid easily.

#### 4. CONCLUSIONS

From the results and discussions, the implementation of the ARCS model in each class motivates the student to come to class and read the concept well. Using the ARCS model, conducting the active learning activities and collaborative activities will improve the performance of the student in any subject. Overall, if faculty can deliver the lecture by understanding how a student learns, then only we can achieve better outcomes. By implementing ARCS, I observed that by creating interest and mentioning the importance of the topic they are learning, students will show interest to learn.

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